Device for transporting a mortar-type heavy weapon on a light all-terrain vehicle

The invention relates to the techniques of transporting autonomous weapons of the artillery-piece type, such as guns or mortars. In particular, is allows a heavy weapon to be transported on the rear platform of a light all-terrain vehicle.

One technique is to tow the weapon behind a vehicle, the weapon being carried by a wheelset and forming a coupling connected to the vehicle. On soft ground, particularly when backing up, there is a risk that the coupling will become bogged down. This reduces the mobility of the vehicle. In addition, it is necessary to maneuver in order to connect the coupling to the vehicle, and this reduces the reaction capability.

Another technique is to fix the weapon permanently directly onto the vehicle, for example on its rear platform. This technique makes it possible to improve mobility and reaction capability but during firings the vehicle is subjected to high stresses resulting from the launch of the projectiles. It is necessary for such a vehicle to be engineered to withstand the forces generated by the recoil of the weapon.

One object of the invention is to transport a weapon without the aforementioned disadvantages, that is to say with better mobility and reaction capability than a towed weapon, and without transmitting the stresses incurred by the launch of a projectile.

To this end, the subject of the invention is, in particular, an interface between a vehicle and a weapon, comprising at least one retractable structure intended to form a mechanical connection between the vehicle and the weapon when it is retracted, the

retractable structure being configured to allow the weapon to move relative to the vehicle when relaxed, such that the stresses induced by the launch of a projectile are not transmitted to the vehicle.

The retractable structure, in the relaxed position, allows the weapon to be kept away from the vehicle while at the same time maintaining a connection with the latter. Firing is done on the ground, and this makes it possible to avoid transmitting the projectile launch stresses. In addition, it is possible for the weapon to move relative to the vehicle. This movement allows the weapon to be extracted from its emplacement on uneven ground.

When the weapon needs to be moved from one location to another, the retractable structure is brought into its retracted position. The retractable structure maintains a connection (tight or relaxed) between the weapon and the vehicle. This connection allows the weapon to be brought up close to the vehicle quickly. The invention thus provides better reaction capability than a towed weapon.

Once the retractable structure has been retracted, the weapon can easily be maneuvered so that it can be set down on the vehicle. The structure in its retracted position allows the weapon to be positioned accurately on the vehicle. Once the weapon has been placed on the vehicle, the invention provides better mobility in comparison with a towed weapon.

The invention allows the boresight of the weapon to be orientated at will. The boresight is not necessarily fixed with respect to the axis of the vehicle, but may rotate through a certain angular field (limited to the travel or mobility of the connection).

Other characteristics and advantages of the invention will become apparent from reading the following detailed description which is given by way of nonlimiting illustration and made with reference to the attached figures, which depict:

- figure 1, a standard mortar intended to be connected to an interface according to the invention;
- figure 2, an all-terrain vehicle, viewed from above, intended to be used as a vehicle for transporting the mortar depicted in figure 1;
- figures 3a to 3d, a mortar connected to an all-terrain vehicle using an interface according to the invention, in a side view, the mortar being in various positions relative to the vehicle;
- figure 4a, an example of an interface according to the invention, in which the retractable structure is in a relaxed position;
- figure 4b, a detail of figure 4a;
- figure 5a, the interface of figure 4a in which the retractable structure is in a retracted position;
- figure 5b, a detail of figure 5a;
- figure 6a, the interface of figure 4a, the weapon being uncoupled from the vehicle;
- figure 6b, a detail of figure 6a;
- figure 7a, a variant embodiment of a retractable structure;
- figure 7b, a detail of figure 7a;

Reference is now made to figure 1 which depicts a standard mortar. The invention allows this weapon to be transported. The mortar depicted is a tube weapon with a rifled barrel 120 mm in diameter. Of course, the invention applies to the transportation of any type of heavy weapon. The mortar comprises a firing tube 10 defining a boresight. The base of this tube is connected by a connection of the ball-joint type to a mortar plate 11, also known as a baseplate. The mortar

is carried by a wheelset comprising wheels 14, connected by arms 13 to an axle 12. The axle 12 is connected to the firing tube 10. An aiming system (for aiming in elevation, aiming in azimuth, and making leveling corrections), fixed to the wheelset, allows the position of the boresight to be adjusted when the wheels and the mortar plate are resting on the ground. The mortar can be towed behind a vehicle by fixing a coupling ring (not depicted) to the free end of the firing tube.

Reference is now made to figure 2 which depicts an all-terrain vehicle viewed from above. This vehicle is intended to be used as a vehicle for transporting the mortar depicted in figure 1. The invention allows a production vehicle to be used. The vehicle depicted is a Hummer HMMWV M1097 A2 model all-terrain vehicle. Of course, the invention may be applied to other all-terrain vehicles and also to trucks. The vehicle 2 comprises a rear platform 21 wide enough for the mortar 1 to be set down thereon.

Reference is now made to figures 3a to 3d which depict a mortar connected to a vehicle by means of an interface according to the invention, in a side view, the mortar being in various positions relative to the vehicle.

Figure 3a depicts the mortar 1 when it is carried by the rear platform 21 of the vehicle 2. In this position, the vehicle can move along. The mortar can be connected to the vehicle by means of a crane 4, depicted in the folded position in this figure.

Reference is made to figure 3b. The crane 4 comprises a first arm 40, one end of which is mounted so that it can rotate on the rear platform 21. The arm 40 is more or less parallel to the surface of the rear platform 21

when the crane 4 is in the folded position (see figure 3a). The arm 40 may be set in motion by a first hydraulic ram 42 forming an integral part of the crane 4. The ram 42 allows the angle between the arm 40 and the platform of the vehicle to be opened up. The movement of the first arm 40 is represented by an arrow F1. This movement allows the mortar 1 to be brought behind the vehicle, above the ground but not in contact with the ground.

Reference is made to figure 3c. The crane 4 comprises a second arm 41, mounted so that it can rotate at the free end of the fist arm 40. The angle between the first 40 and second 41 arms is practically zero when the crane 4 is in the folded position (see figure 3a). The second arm 41 can be set in motion by a second hydraulic ram 43 forming an integral part of the crane 4. The ram 43 allows the angle between the first 40 and the second 41 arms to be opened up. The movement of the second arm 41 is represented by an arrow F2. This movement allows the mortar plate 11 to clear the rear of the vehicle, thus allowing the mortar plate to be brought (by rotation) into the appropriate position before the mortar is set down on the ground. The movement of the second arm continues so as to open up the angle between the two arms to as wide an angle as possible.

Reference is made to figures 3b and 3c. The two rams 42, 43 are operated so as to bring the mortar into the position in which it will be set down. The wheels are still raised, that is to say not in contact with the ground.

Reference is made now to figures 4a and 4b, which depict one example of a retractable structure in a relaxed position. This retractable structure 3 connects the mortar 1 and the crane 4. It comprises, according

to one advantageous embodiment, it comprises a forked gantry 30 fixed to the second arm 41, a cable 32 placed within each fork of the gantry, and an electric winch 31 for winding the cables. In the relaxed position, the cables emerge partially from the gantry (cable slack). This position is depicted also in figure 3d.

Having operated the rams to set the mortar plate 11 down, the electric winch around which the two cables are wound is operated in order to set the two wheels 14 down on the ground by virtue of the ball-joint-type connection between the tube and the mortar plate. The vehicle can then move away from the mortar, as indicated by the arrow F3 in figure 3d.

Thus, by using the interface described, emplacement is performed by deploying the crane, moving the mortar clear by distancing the gantry, rotating the mortar plate, and setting the weapon down on the ground. Control may be had through manual action on a conventional control unit.

Extraction from its emplacement is performed by carrying out the reverse operations, that is to say by bringing the vehicle up as close as possible to the mortar (minimum distance between the gantry and the axle) then rewinding the cables, folding the crane, and setting the mortar down onto the vehicle.

A retractable structure that is equivalent from a functional standpoint to the one depicted in figures 4a and 4b may be obtained by replacing the cable with any other flexible element (strap, nylon rope, chain, etc) and the electric winch with any other traction member (hydraulic ram, moving cam, etc.). Whatever it might be, the flexible element connects the vehicle to the weapon (via the crane in this embodiment) and the

traction member is designed to relax and to retract the flexible element.

Reference is made to figure 4b which depicts a detail of figure 4a. According to a preferred embodiment, the retractable structure is equipped with self-centering elements. The self-centering elements are designed to come into register with one another when the structure 3 is retracted. They thus perform a self-centering function. Use may be made of male and female complementary shapes intended to fit one inside the other (cones, hemispheres, etc). The self-centering elements allow the components to be realigned with one another quickly, facilitating emplacement extraction.

Advantageously, the self-centering elements are configured also to maintain their position against forces that tend to apply shear to the cable during transport, emplacement or extraction from emplacement. The self-centering elements thus afford the cable some protection. The self-centering elements may for example be a male cone 60 and a female cone 61, orientated in such a way that their axes are more or less parallel to the direction of the cable when the cable is under tension.

According to one advantageous embodiment, clamping (not depicted) is provided for mechanically anchoring the cones to one another. The function of this clamping is to prevent the cones from dislocating once they have been nested one inside the other. It makes it possible to avoid having to leave the winch motor powered while the mortar is being transported. The clamping may be afforded by a pin for example.

Reference is made to figure 5a which depicts the retractable structure of figure 4a in the retracted position. In this position, the cable is taut inside

the gantry and the cones are nested one inside the other.

Reference is made to figure 5b which depicts a detail of figure 5a. The interface is connected to the mortar by connecting means 8. According to one embodiment, these connecting means are formed by a mechanism involving jaws. This mechanism, depicted in figure 5b, is configured to be lockable around a tubular part of the mortar, such as the axle tube 12, while at the same time maintaining a degree of freedom in rotation about the axis of the tube. In other words, the mechanism involving jaws is locked with clearance so that the male cone 60 can run freely about the axle 12 when the jaws are locked. This degree of freedom in rotation allows the cones to be nested one inside the other more easily.

The mechanism involving jaws which is depicted in figure 5b comprises two half-shells 80, 81 connected by an articulation. These half-shells fit around the axle 12. They are connected on the other side from the articulation by a locking system, for example of the screw-nut type or a latch lock lever (depicted in figure 5b). This mechanism allows the interface to be fitted to standard mortars.

Advantageously, the mechanism involving jaws can be locked by a latch lock lever 82. This allows more rapid clamping than a screw-nut system. The latch lock lever can be locked manually using a lever handle 83 for example.

Reference is now made to figures 6a and 6b which depict an advantageous embodiment. The interface comprises uncoupling means, designed to uncouple the cable (or more generally the flexible element) from the weapon. These means are configured to be manually operable.

These means may be formed by an end-fitting 62 (wrist pin) and a housing 63 (bore). The end-fitting may be placed at the cable end connected to the mortar. The housing may be produced in a part integral with the male cone 60. It is also possible to anticipate a hook-ring system. The uncoupling means allow the vehicle to be moved even further away from the weapon (beyond the length of the cable).

Reference is now made to figures 7a and 7b which depict a variant embodiment 7 in which the flexible element is replaced with a rigid element 71. The rigid element can be operated in order to leave some slack between the vehicle and the weapon. It has, for example, the shape of a paperclip. This paperclip 71 is designed to slide in the gantry 30. It surrounds the axle tube 12 at a bore 70. When the rigid element is retracted, the axle tube is kept in contact with the gantry 30.

In the foregoing exemplary embodiments, the interface is equipped with two retractable structures connected to the axle 12 of the mortar. Of course, just one retractable structure will suffice. However, the interface according to the invention advantageously comprises at least two retractable structures.